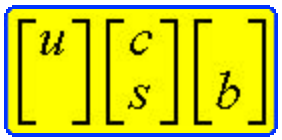


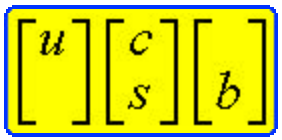
UCSB High Energy Physics Group

$$\begin{pmatrix} u \end{pmatrix} \begin{pmatrix} c \\ s \end{pmatrix} \begin{pmatrix} b \end{pmatrix}$$

HEPAP Meeting

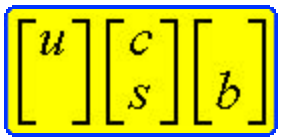
July 17, 2000

Jeffrey D. Richman



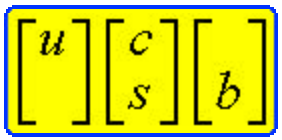
Outline

- People
- Goals and Priorities
- Projects and research highlights
- Issues for HEP



UCSB HEP Group

- Faculty
  - David Caldwell (emeritus)-CDMS
  - Claudio Campagnari-BaBar
  - Rollin Morrison-CLEO; Dept. Chair
  - Harry Nelson-CDMS, CLEO
  - Jeffrey Richman-BaBar, (CLEO); P.I.
- Senior Research Physicists
  - Dan Bauer
  - Al Lu
  - Steve Yellin
- Postdocs
  - Philip Hart
  - Tony Hill
  - Owen Long
  - Wouter Verkerke
  - Jeff Gronberg (search underway for replacement)
- Technical Staff
  - Sam Burke (electrical engineer)
  - Dave Hale (senior group engineer)
  - Susanne Kyre (mechanical engineer)
  - Dan Callahan (technician)
  - Julie May (wire bonder)
  - Lap-Yan Leung (computer system manager, half-time)
- Graduate Students
  - David Asner
  - Ray Bunker
  - Brian Dahmes
  - Anton Eppich
  - Natalia Kuznetsova
  - Steven Levy
  - Craig Maloney
  - Michael Mazur
  - Joel Sanders



Faculty Recruitment

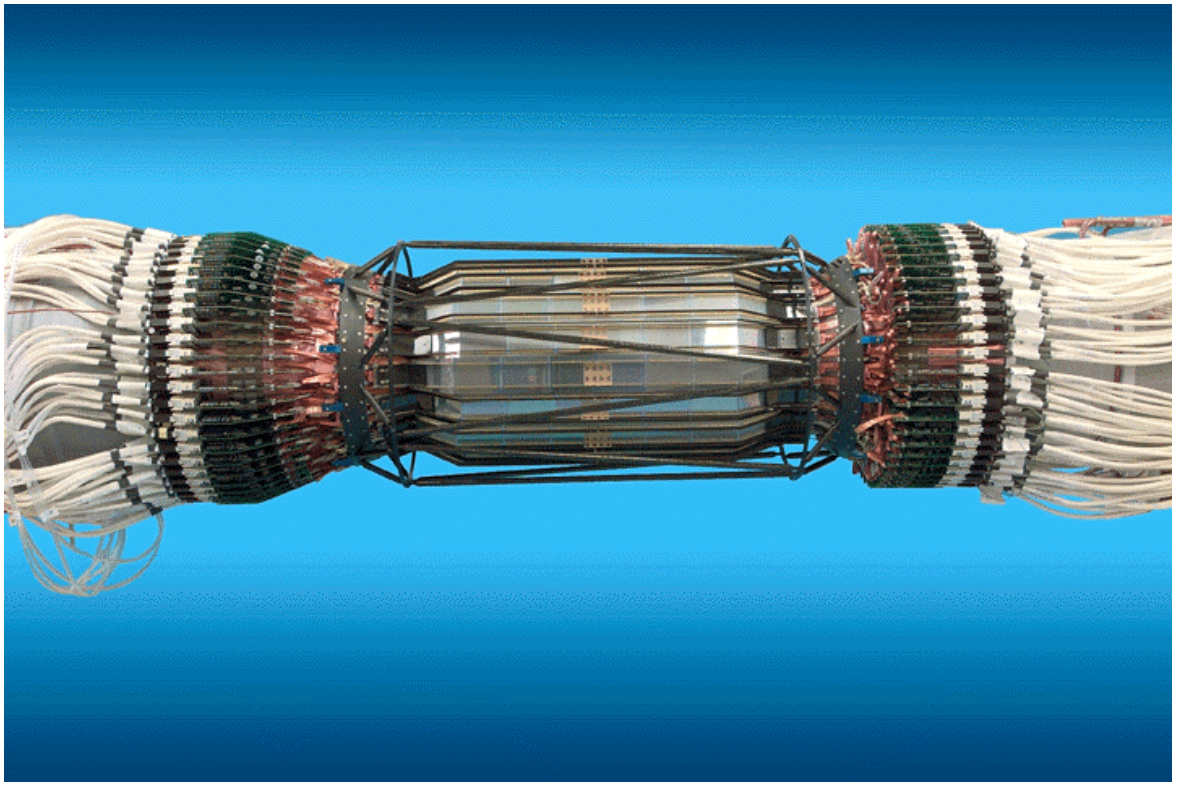
- The departure of Michael Witherell to become Fermilab Director created both a problem and an opportunity for our group.
- We are adding a new experimental area to diversify our program, to create broader opportunities for students, and to bring in new hardware projects.
- We are in the final phase of a senior-level hire which we believe has a very good chance of success.
- The UCSB administration has been very supportive with regard to startup funds and other resources.
- The UCSB Physics Dept. has also been very supportive. Relations between HEP and other fields are collegial.
- We expect to begin an additional search for an assistant professor to help build the new group.

Goals and Priorities

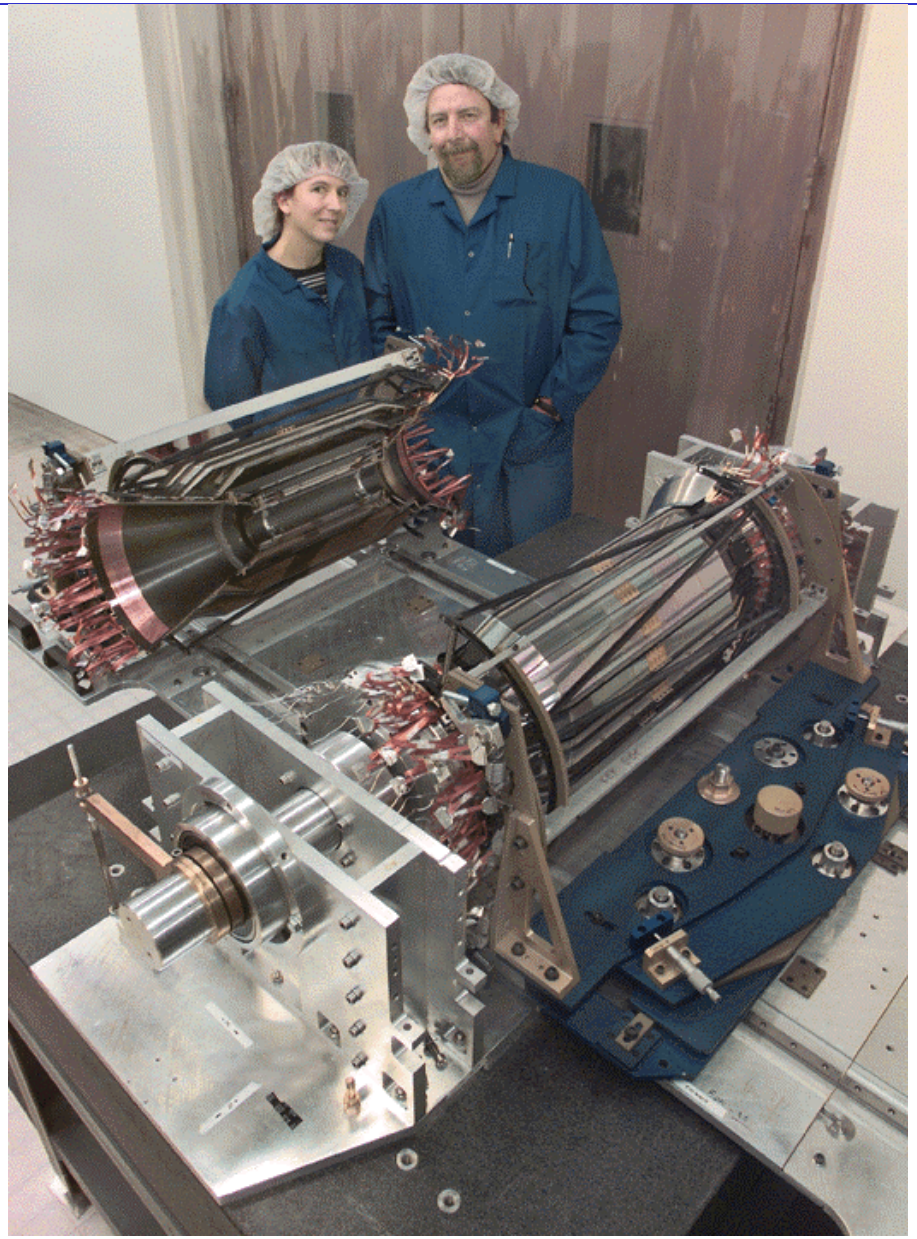
- Our approach is to play a major role in a small number of high-impact projects rather than a smaller role in many projects.
  - We can take on challenging detector construction projects.
  - Group members can learn from each other in data analysis.
  - Cooperation in group efforts creates a sense of group coherence and achievement.
- We try to maintain a roughly even balance between detector construction projects and data reconstruction/analysis. Both are essential for training students and postdocs.
- One of our highest priorities is to maintain our engineering and technical staff, who have many years of HEP experience.
- Detector construction helps keep a core of activity based at UCSB. This has many benefits, including good relations with other fields in the Physics Department.

Research Highlights: BaBar

- UCSB played a major role throughout the design, construction, commissioning, and software development for the BaBar Silicon Vertex Tracker (SVT).
- Our engineering staff and Physics Dept. machine shop were essential for this project.



BaBar Silicon Vertex Tracker

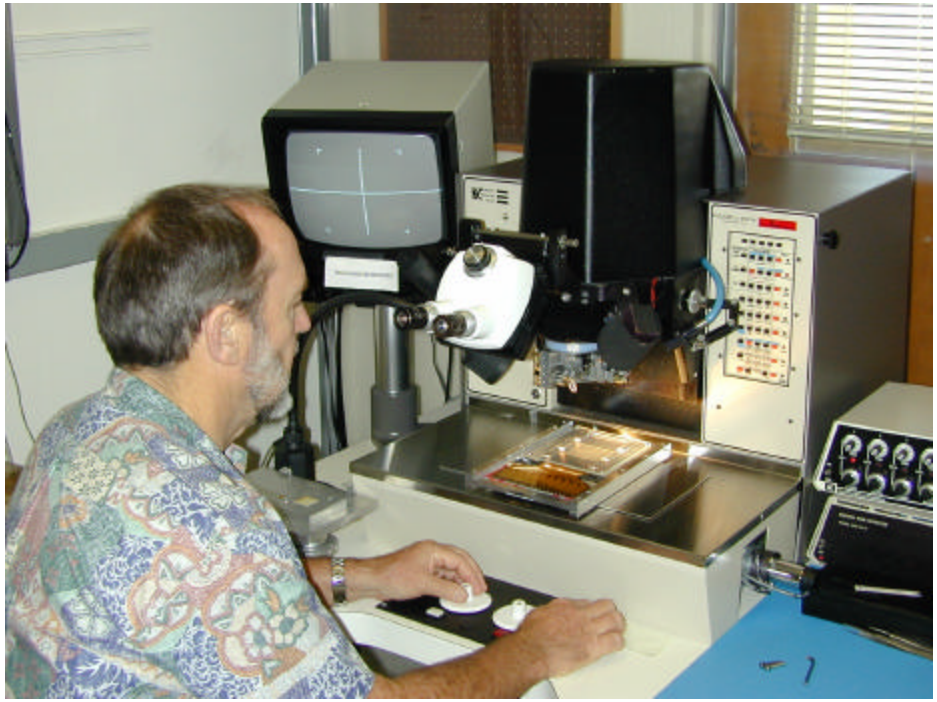


UCSB engineers Dave Hale and Susanne Kyre during BaBar SVT assembly.

- After construction: major group efforts on SVT commissioning, calibration, alignment, and tracking software.
- Startup of physics analyses on CP violation and rare B decays
- We have also played a large role in the organization and leadership of BaBar data analysis groups.

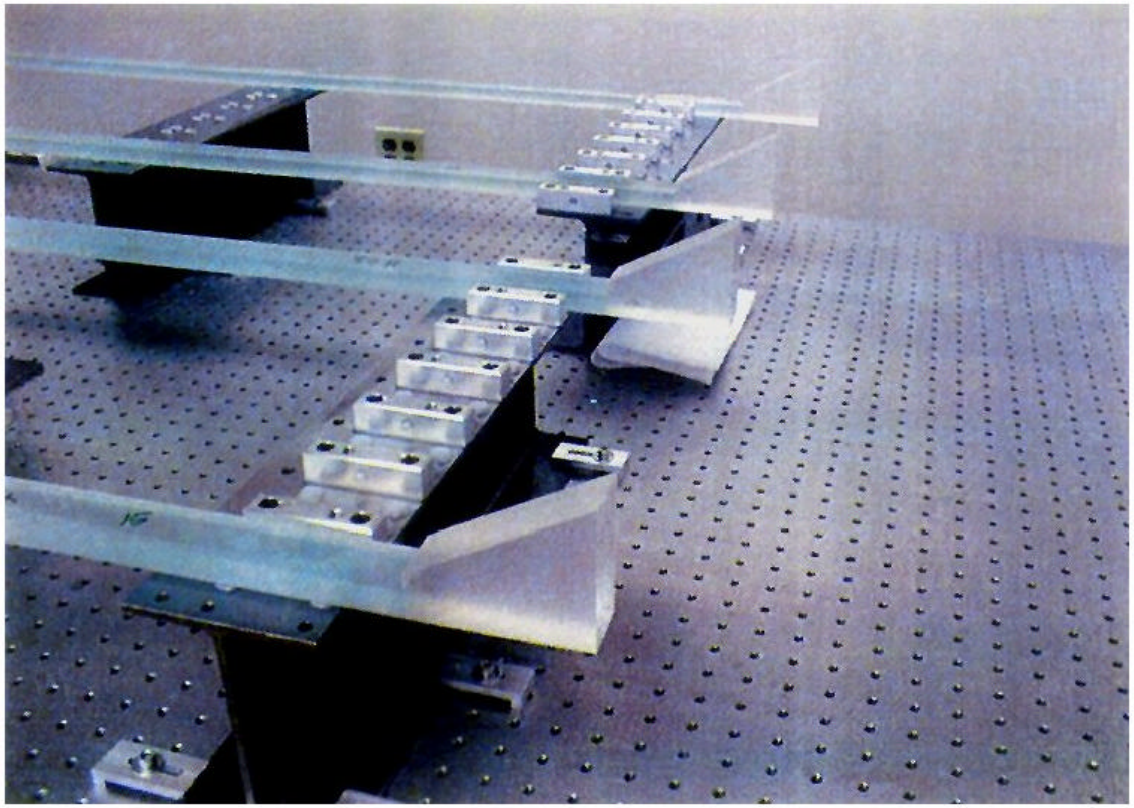
Silicon Detector Assembly Infrastructure

Sam Burke with automated electrical test system for BaBar SVT.



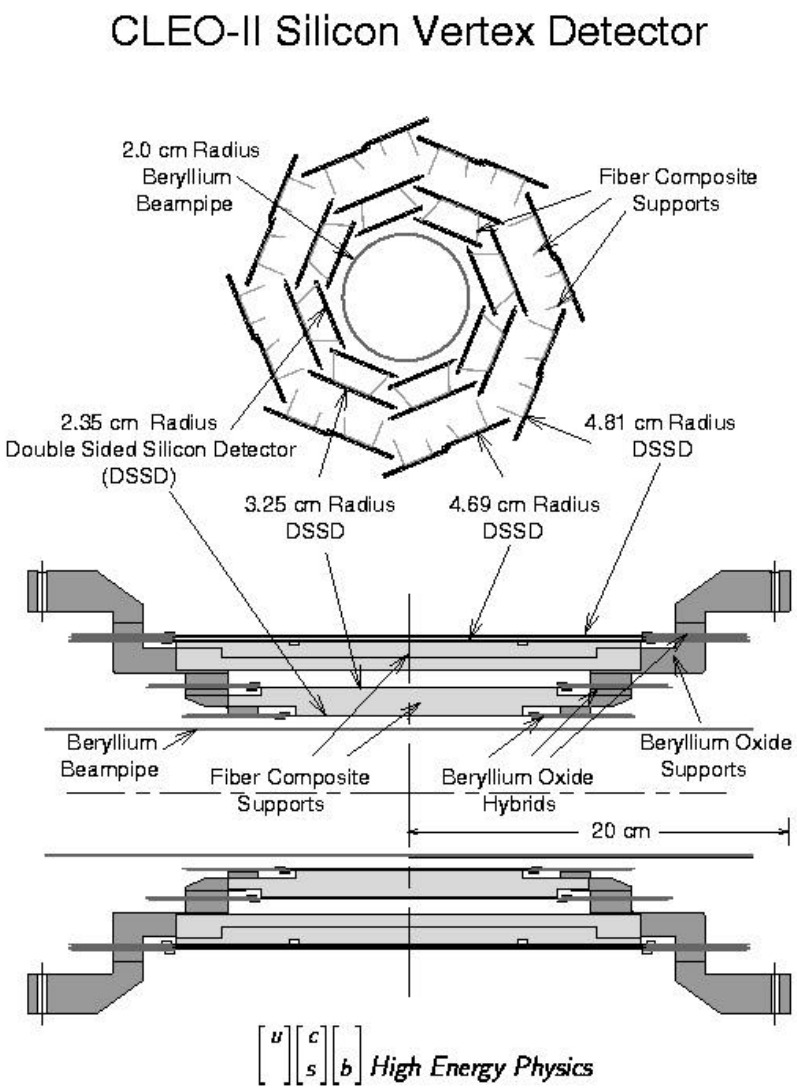
Computer-controlled wire bonding required a major effort; the minimum bond pitch was 43 μm.

BaBar DIRC Quartz Bars



UCSB was also involved in the BaBar particle-ID system (DIRC). Al Lu, a senior staff physicist, was a key person in development of the quartz bars, one of the most difficult parts of the experiment.

CLEO SVX

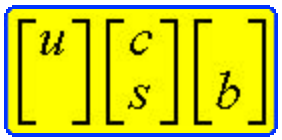


UCSB was the lead institution for construction of the first CLEO silicon vertex detector.

This detector operated in CLEO from 1995 to 1999.

Much of the experience gained from this project was applied to the BaBar SVT.

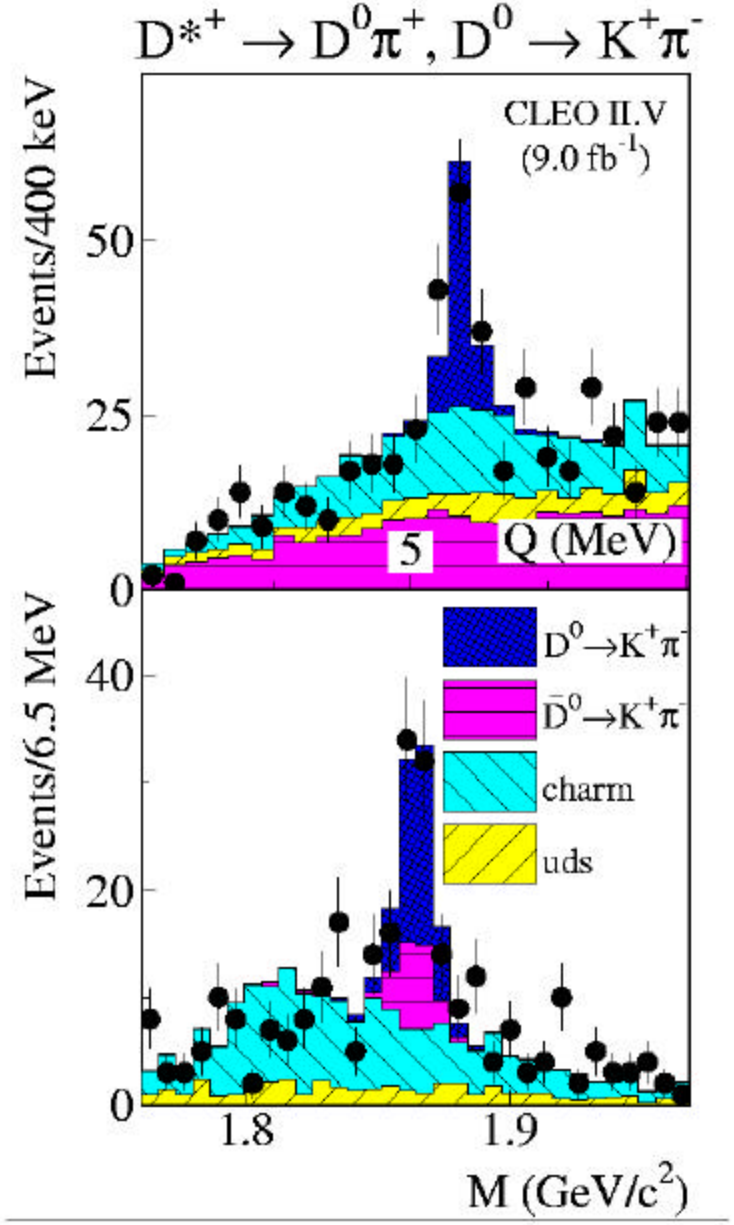
(UCSB is not part of the CLEO 3 upgrade.)



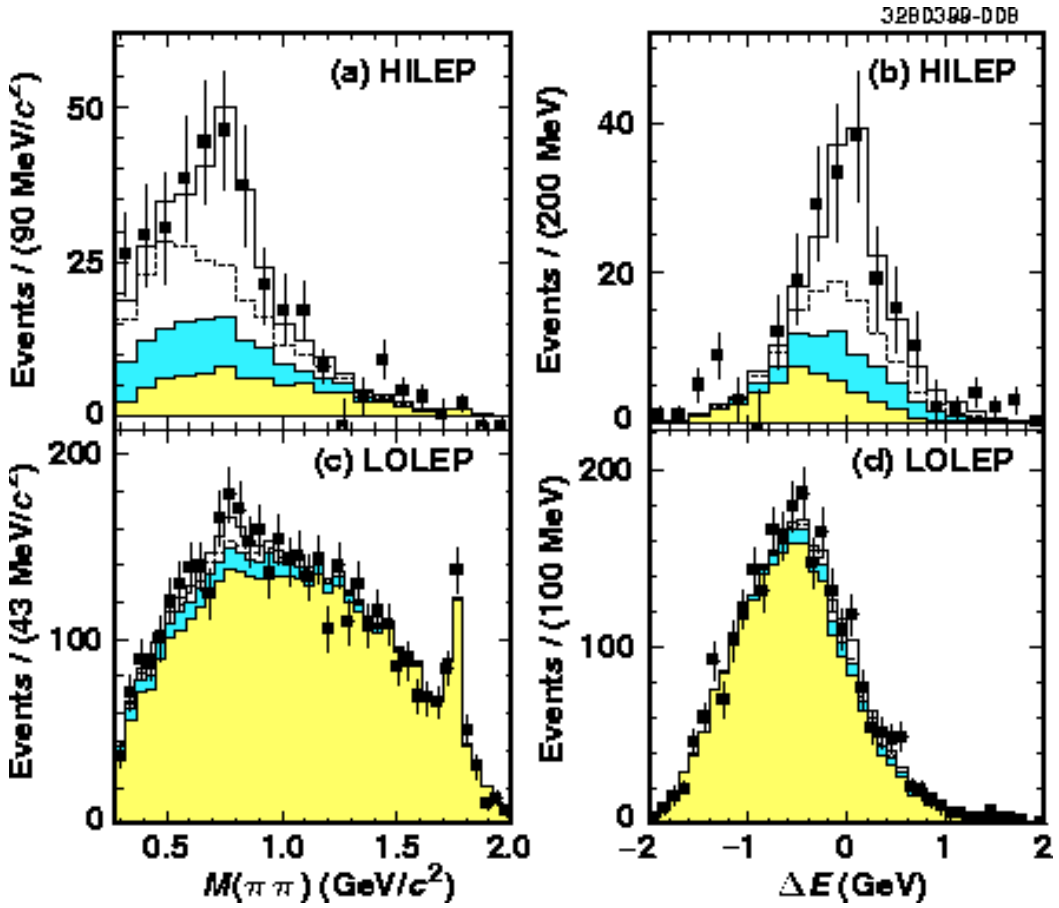
CLEO/UCSB Physics Papers

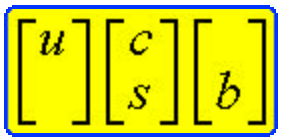
• Limit on |Vub/Vcb|	PRL 70, 2681 (1993)
• D^0 and D^+ semileptonic decays	PL B317, 647 (1993)
• Branching fraction fro $D_s \to \phi l \nu$	PL B324, 255 (1994)
• Cabibbo suppressed decay $D0 \to \pi l \nu$	PR D52, 2656 (1995)
• Semileptonic D_s decays	PRL 75, 3804 (1995)
• Inclusive and exclusive $B \to D_s$ decays	PR D53, 4734 (1996)
• Form factors in $B \to D^* l \nu$ decays	PRL 76, 3898 (1996)
• Absolute branching fractions for $D_s \to \phi \pi$	PL B378, 364 (1996)
• Branching fraction for $B \to D^* D^*$	PRL 79, 799 (1997)
• Hadronic D_s decays	PR D58, 052002 (1998)
• Measurement of $B(B \to D^* \pi)$	PRL 80, 2762 (1998)
• Measurement of $B \to \rho l \nu$	PRD 61, 052001 (2000)
• D^0 mixing; doubly Cabibbo supp. decay	submitted to PRL

CLEO/UCSB Results Published in 2000



- D^0 Mixing Analysis: order of magnitude improvement in sensitivity
- Measurement of B-> ρ l ν and Vub

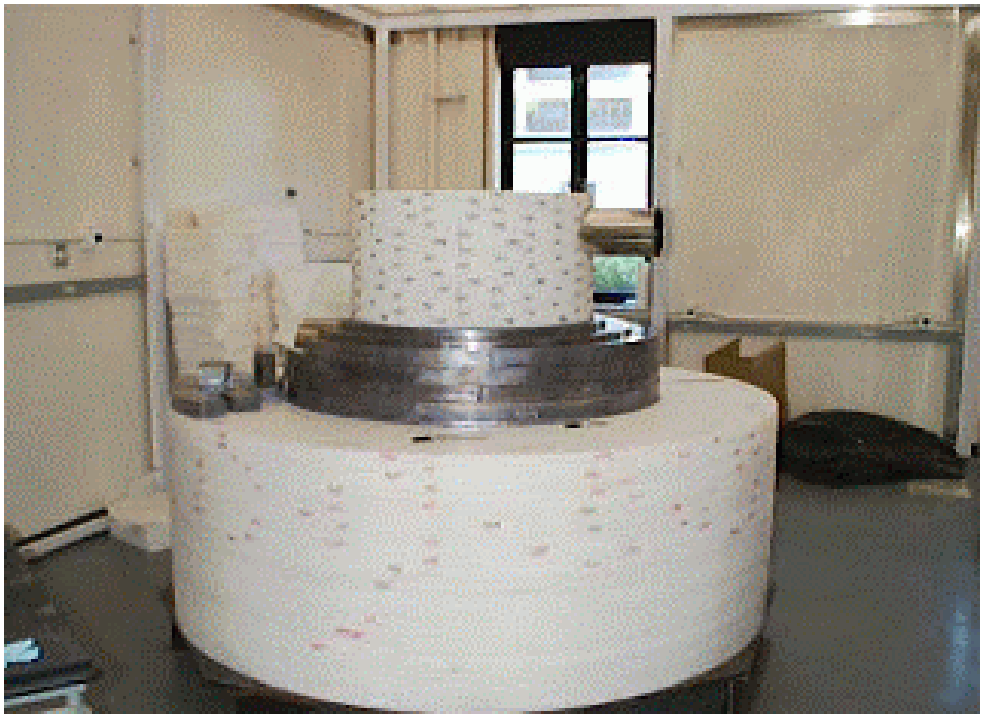




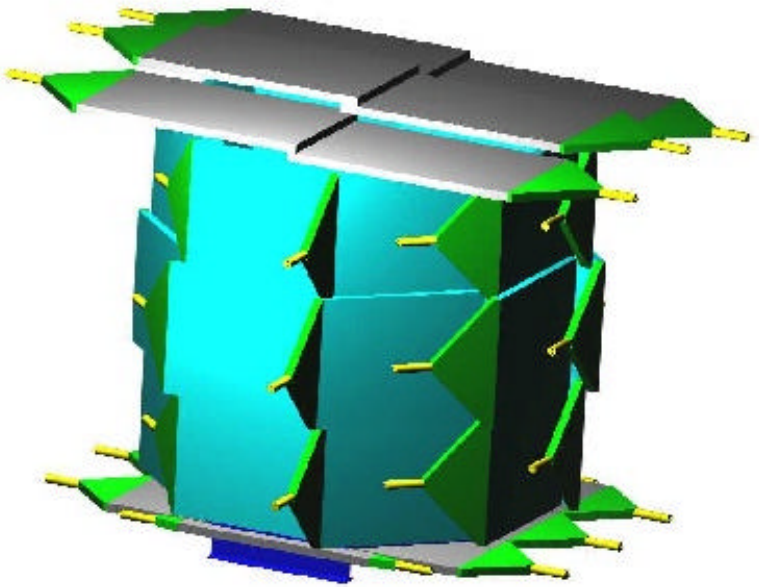
Cryogenic Dark Matter Experiment (CDMS)

- Our group has extensive experience in very low-background underground experiments, including a joint UCSB/LBL $\beta\beta_{0\nu}$ search.
- UCSB has been part of CDMS since its inception in 1991
  - CDMS I: a pilot experiment that been operating in the Stanford Underground Facility
  - CDMS II: a scaled up experiment now under construction; will be installed in the Soudan underground laboratory.
- Main idea: search for WIMPs using both ionization and phonon signals to detect nuclear recoil and suppress backgrounds.
- UCSB is responsible for trigger, DAQ, shield, and scintillator veto system; the detectors are being developed by Berkeley and Stanford.

CDMS II Construction

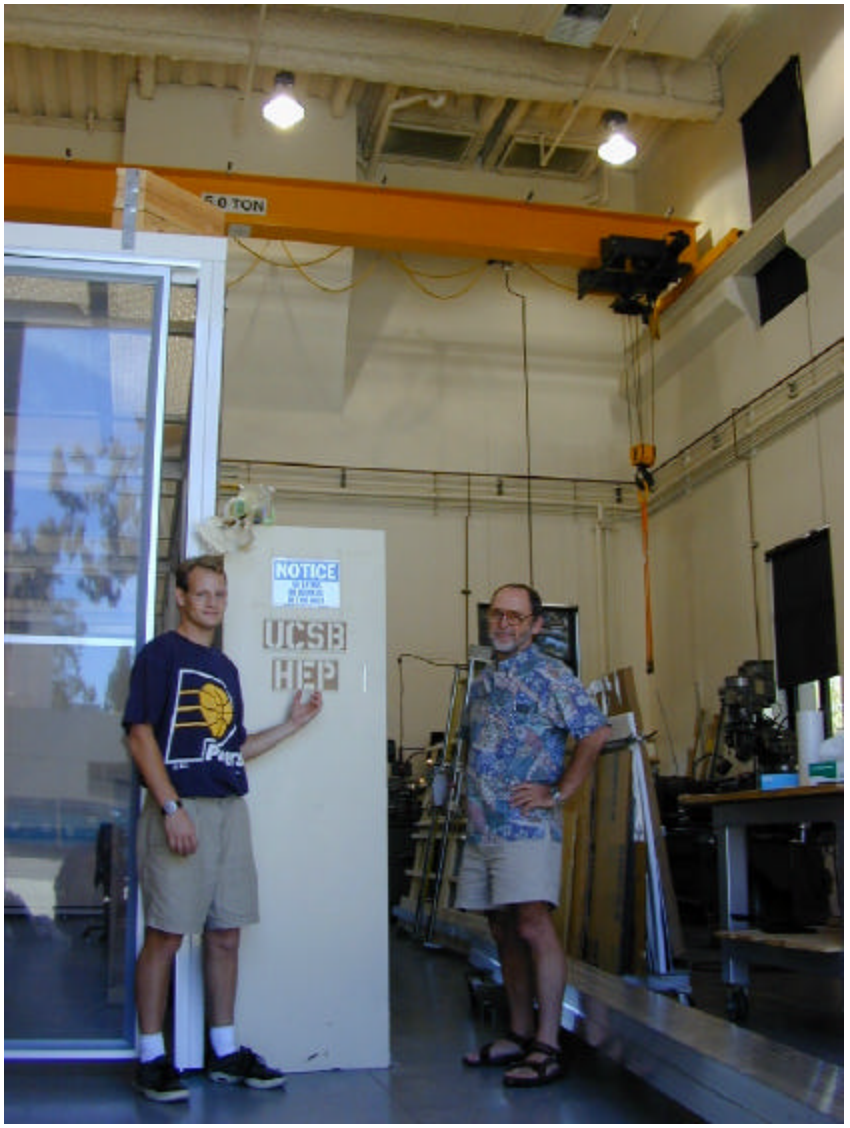


CDMS II shield test assembly in UCSB high-bay; this is adjacent to the Physics Dept. machine shop.

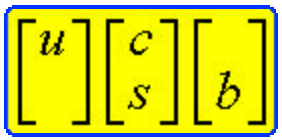


CDMS scintillator veto system.

CDMS II Electronics and HEP High Bay

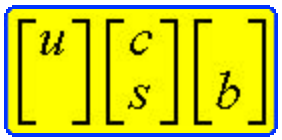


Sam Burke (electrical engineer)
and Joel Sanders (graduate student)
above: working on the CDMS II trigger
right: in the HEP High Bay



UCSB in the HEP Community

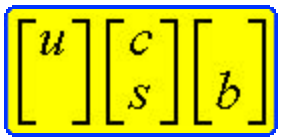
- Rollin Morrison
  - chair of Fermilab PAC (1995-1997)
- Harry Nelson
  - CMS Lehman review committee (1998)
  - CDF/D0 Lehman review committee (1999-2000)
- Jeffrey Richman
  - Fermilab PAC (1997-2001),
  - SLAC EPAC (1998-2001),
  - LBNL Director's review committee of Physics Division (1998, 1999)



Former Graduate Students 1988-1999

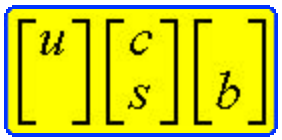
Graduate students and postdocs in our group receive broad training in both hardware and data analysis. This training enables them to be successful in obtaining positions in science and technology.

Year	Student	Current (or last known) Position
1999	D. Lange	postdoc, Livermore
1999	A. Sonnenschein	postdoc, Princeton
1998	T. Nelson	postdoc, Fermilab
1996	A. Ryd	Fairchild Fellow, Caltech
1996	C. Qiao	Project Leader, Engelhard Sensor Technologies, Goleta
1995	M. Gray	Wall Street
1994	D. Borden	Wall Street
1994	D. Sperka	computer consultant, Madison
1993	J. Duboscq	research physicist, Ohio St. U.
1993	J. Huber	research physicist, LBNL (medical imaging)
1992	D. Schmidt	staff, LANL (medical imaging)
1990	R. Stephens	assistant professor, U.T. Arlington
1990	D. Grumm	AXAF project, Smithsonian Astrophysical Laboratory
1988	T. Barker	associate professor, U. Colorado
1988	T. Browder	associate professor, U. Hawaii



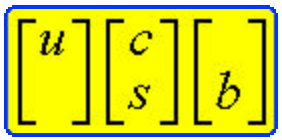
Former UCSB Postdocs, 1992-1999

Year left	*Name*	*Current (or last known) position*
1999	Jeff Gronberg	research scientist, LLNL
1998	Doug Roberts	assistant professor, U. Maryland
1996	Scott Menary	assistant professor, York U. Toronto
1996	Rob Kutschke	research physicist, Fermilab
1995	Hiro Tajima	research faculty, Univ. of Tokyo
1992	Alice Bean	associate professor, Univ. of Kansas



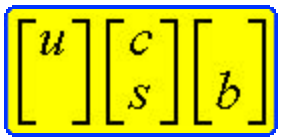
Issues for HEP (a personal view...)

- The program at US HEP laboratories up until about 2008 is extremely strong, with a remarkable number of exciting experiments. The success of these experiments can serve as a springboard for a major future initiative.
- BaBar, CDF, D0 , ATLAS, CMS and other experiments are also serving to strengthen international ties.
- The current intense activity is, however, distracting many of us from the seriousness of the problems we face in launching a major new accelerator in the US.



Issues for the HEP Community (II)

- What will be the US HEP program after LHC startup?
- Is an electron linear collider the right machine to build? How strong is the physics case as a function of energy and luminosity?
  - Many of our colleagues believe that the NLC is essential, while others are very skeptical. We have not reached a consensus.
  - We need a detailed assessment of the physics case, feasibility, and cost.
  - These must be fully documented so that they can be reviewed by the HEP community. Without this, we will not be able to reach a consensus.
  - The remaining R & D issues must be clearly identified, so that we can understand how far away we are from a machine that we can confidently build.
  - The case for the NLC must be held to a extremely high standard, especially because the need for this machine will be challenged by critics of HEP.
  - Is there a coherent and detailed plan for producing this assessment?



Issues for the HEP Community (III)

- From recent difficulties in Washington, we can see that even our current funding level in HEP is quite vulnerable. How can we improve this situation?
- From previous machines, in particular the SSC, we have seen that mistakes in management can be extremely costly. How can we avoid making these mistakes (and new ones) in the future?
- Recent improvements in SLAC/FNAL cooperation is extremely encouraging. Are there ways in which the laboratories can usefully broaden this cooperation?
- We may be entering one of the most exciting periods in US HEP. We need to convey the extraordinary scientific potential of this research to the broader scientific community and to the public.